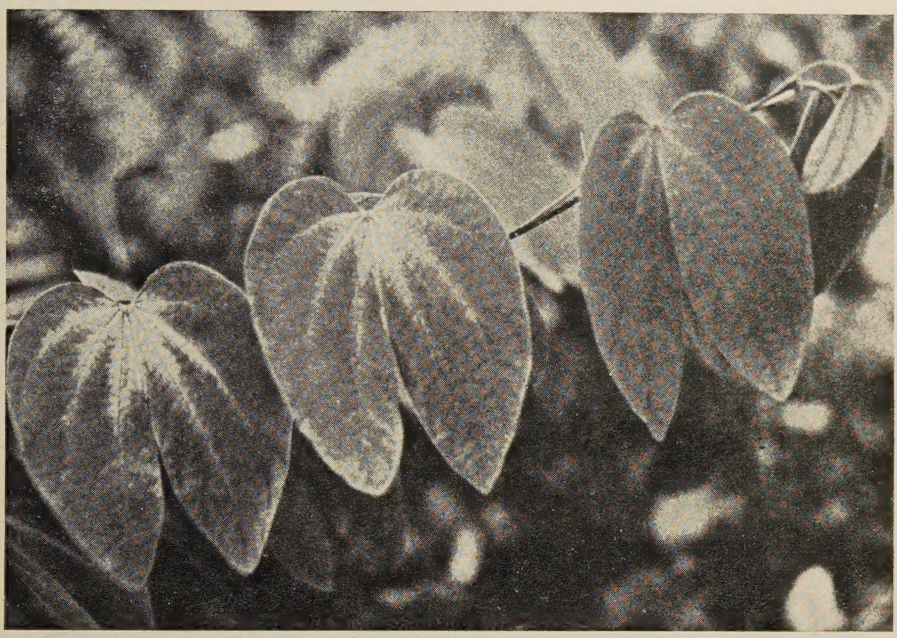
PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA



NEW SERIES NUMBER SEVENTEEN

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1955

R R I

LOCATION. The institute's laboratories and offices are at the third mile, Ampang Road, Kuala Lumpur.

CORRESPONDENCE. All LETTERS must be addressed to the Director, Rubber Research Institute of Malaya, Post Office Box 150, Kuala Lumpur. Special inquiries may be marked for the attention of particular officers. The address for TELEGRAMS is Searching, Kuala Lumpur. TELEPHONE: Kuala Lumpur 3351. PARCELS occasionally arrive without any indication of their origin. Senders' names and addresses should be written clearly on the outside of all packages, and the institute should be advised of despatch by letter or telegram.

PROHIBITED PLANT SPECIMENS. Attention of planters and others in territories outside the Federation of Malaya and the Colony of Singapore is drawn to the Malayan Plant Importation Rules which prohibit the importation into Malaya of any part of a plant, whether living or dead, unless it is accompanied by a permit issued by the Director of Agriculture, Federation of Malaya. No permit will be issued in respect of any diseased plant or any plant pest. Any plant imported in contravention of these Rules (whose object is to prevent the introduction of diseases or pests) will be destroyed without examination. Anyone outside Malaya who desires our advice on any matter that may require examination of living material must first inquire by letter.

ADVICE. Inquiries are invited from rubber producers in the Federation of Malaya, the Colonies of Singapore and North Borneo, and the territories of Sarawak, Brunei and Nigeria, who may require more detailed information applicable to their own special problems. INTERVIEWS should be arranged by letter or telephone, as members of the senior research and advisory staff are frequently absent on visits to plantations. The institute is open from 8 am to 1 pm and 2 pm to 4 pm on Mondays to Fridays, and from 8 am to 12.30 pm on Saturdays.

EXPERIMENT STATION AND FACTORY. This station of the R R I is situated 16 miles from Kuala Lumpur, at Sungei Buloh on the Kuala Lumpur — Kepong — Kuala Selangor road. Visits may be made on Mondays or Wednesdays by arrangement. There is a guest house.

PUBLICATIONS. A list of 'Publications of the R.R I.' is available on request. Subscription may be made by depositing $15 with us. An annual statement of account will then be submitted.

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Kuala Lumpur March 1955 Number 17

Editorial: Statistical Methods

A feature of agricultural and biological research during the past thirty years has been the widespread introduction of statistical methods in the design of experiments. This revolution owes much to the pioneer work of Sir Ronald Fisher and his classic *Statistical Methods for Research Workers*. Much of the early work on the statistical design of experiments was applied to field experiments with annual crops, notably at the Rothamsted Experimental Station in England, but the R.R.I. was a relatively early convert to the new ideas and a statistics section was formed in 1937 to advise research officers on the uses of statistics in the conduct of field and laboratory experiments.

No practical field experimenter believes that his observations are entirely free from error, although he may sometimes underestimate the extent of this error. In any trial with hevea the observations are influenced by many factors other than those specifically under test. Some of these factors—such as soil differences in the trial area or varying skills of tappers—are recognisable but others remain anonymous and outside the control of the experimenter. The effect of all these extraneous factors is to introduce into the observations additional variability which is conveniently called experimental error. Statistical methods and, in particular, the ideas of randomisation and replication allow the size of this error to be estimated and the reliability of the trial judged. This requirement, that each trial should also provide an estimate of its own accuracy, was a major change in the approach to field experiments and led to the development of certain 'tests of significance'.

Nowadays, readers of technical journals find their path strewn with statements such as 'the difference between treatments A and B was significant at the 1 per cent level'. A difference has been observed between the material receiving treatment A and that receiving treatment B, and a decision is needed on whether this is in fact due to the different treatments or whether it has arisen accidentally. Is it possible that such a difference might have been observed even if the treatments had been identical? The quotation above implies that the probability of such a difference arising accidentally, from so called random error, is only 1 in 100; the experimenter thereby knows the degree of confidence he can attach to the conclusion that a real treatment difference exists.

This idea of significance has been so developed that before starting many experiments it is possible to estimate the amount of work which must be carried out in order to establish a sufficiently confident conclusion. One of several ways in which money can be wasted in carrying out field experiments is to conduct them on such a lavish scale that their conclusions are indicated with an unnecessarily high degree of

confidence; another way is to do too little experimentation so that a result may be demonstrated and suspected but not established with confidence. This leads to an unduly high risk of asserting the wrong conclusion or else time is wasted seeking confirmation.

Statistical methods have also been responsible for a greater use of factorial designs. The classical approach to a manuring experiment to test the effect of nitrogen, phosphate, and potash, would probably have involved tackling the problem in three parts; the presence and absence of nitrogen would be compared in one section, phosphate in another and potash in a third. But this fails to supply information on how the presence of one manure may modify the effect of another. Nowadays such a trial is usually planned as a factorial $2 \times 2 \times 2$ experiment in which the two levels of nitrogen are combined factorially with the levels of phosphate and potash to give eight treatment combinations ranging from a control having no manures to a treatment involving the presence of all three manures. This not only provides information on the effect of nitrogen, phosphate, and potash, but also on how they interact.

Some of the criticism directed at statistical design and analysis of experiments has been deserved, but invariably the fault lies not in the principles but in the details of their application. Procrustes, the fabulous Greek robber who used to fit victims to his famous bed by either stretching or amputating is said to have delivered an equally fabulous lecture to the Athenian Statistical Society on the amazing uniformity in the stature of Greek travellers. Likewise the practice of introducing unreasonable artificialities into an experiment to satisfy some minor statistical requirement is unjustified and unnecessary. For example, in a trial to compare the yields per acre of various clones it is mathematically desirable for all plots to have the same number of trees in yield recording; but if a particular clone is subject to brown bast and some trees cease to yield, it is incorrect to record additional trees in these plots in order to maintain a constant number of recording trees per plot. The object of the trial is not to estimate the yield of clones when enjoying undeserved immunity from brown bast. Experimenters sometimes complain of the complexity of statistical designs but usually simpler alternatives are available which, at a cost of some loss in precision, present few practical difficulties.

The main essentials for an experiment are that it should be practical and that its objects should be clearly understood, but it is also urged that statistical design can increase the value of an experiment without interfering with its practicability or grossly increasing its labour.

Skim and Skimmings

Skim rubber should not be confused with 'skimmings'. Skim sheet and skim crepe are prepared from the watery fraction left after concentration of field latex either by centrifuging or by creaming. Skimmings, on the other hand, are a crepe form of rubber made from the surface skimmings of field latex before it is coagulated (field latex skimmings) or from small amounts of froth and coagulum produced in the handling of latex concentrate during processing (concentrated latex skimmings).

Wounds and their Treatment

THE OBJECT IN TREATING WOUNDS is to protect exposed surfaces against attack by insects and fungi, and to encourage healing. It is not always necessary. After budding for example, the one year old stocks are pruned and heal satisfactorily without any treatment being applied to the cut. Although *Botryodiplodia theobromae* and other fungi quickly penetrate the snag they are not able to extend their attack to the scion. The rot is cut off by a gum barrier; the dead snag in time falls off, or is gradually squeezed out, and the wound heals over. Similarly with branches, the 'hat peg' left behind when a branch falls will decay but it rarely starts an infection in the trunk. In transplanting budded stumps it is not customary to apply a dressing to the severed roots, though they are rather more liable to termite attack than when the root system is entire, and the white lead paint or grafting wax that is sometimes put on the severed stem is meant only to reduce water loss.

The defensive mechanism of a vigorously growing tree is able to cut off all but the most active parasites, such as the root disease fungi, and even these are sometimes halted though the requirements for this to happen are not understood. A tree that has been seriously weakened by drought or by leaf disease may lose the ability to stop a relatively weak infection starting in the green tissues from extending down the branches, causing terminal dieback. In such cases pruning is resorted to, the branch or root regenerating from side branches. The dressing that should then be applied as a precaution to the cut does not need to stimulate healing; it should be fungicidal, water resisting and adhesive. Coal tar is quite satisfactory.

Use of Crude Petrolatum – With stem wounds the position is different. Here the chief concern is to promote rapid healing and, at panel level, to produce a smooth surface that is easily tapped over. For this purpose no better material is known than a crude petroleum jelly or petrolatum. Applied to the freshly exposed surface of the wood it enables the bark to reform from cambial tissue that arises from the ends of the medullary rays. Without a dressing the wound closes over slowly from the edges. Several products are locally available and are cheap. It is important to secure one that has the right consistency—soft enough that it can be applied neat by hand as a thin smear. Both Standard Vacuum product 2295-C and Shell Otina C are recommended. The dressing should be put on when the trees are dry; difficulty is experienced and adhesion is poor when it is applied to a wet surface.

Mechanical injuries of the stem rarely become infected, whether they are caused by tapping or malicious slashing, by deer or by other animals feeding on the bark. Petrolatum can be applied as the only treatment, after the edges of the wound have been smoothed off. Even old mouldy rot wounds, the relics of severe and untreated infections, can be encouraged to heal over though it is unlikely that they can ever be made fit for future tapping. This emphasises the importance of eradicating the disease by fungicidal applications as soon as it appears.

When treating an infected stem wound such as an old black stripe case, or in cleaning up a bark burst, the first operation is to remove the pad of coagulum and cut away all discoloured bark and wood. The exposed surface should then be sprayed with a fungicide that is harmless to regenerating tissues. The water miscible tar acid preparations

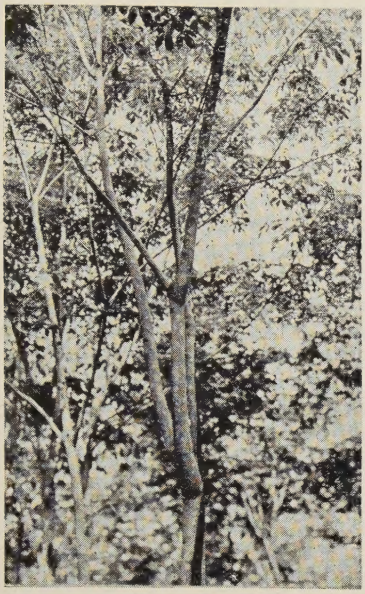
used against mouldy rot are suitable at the upper limits of the ranges given on pages 58 and 59 of *Planters' Bulletin 6*. When the surface has dried the wound can be smeared with petrolatum. There are, however, two situations in which petrolatum should not be used. If exposed to full sunlight it will melt and may actually retard healing; if used near jungle it may attract the attentions of wild pig.

Asphalt Kerosene Mixture – An entirely safe alternative, but one that is much less efficient in promoting healing, is the asphalt and kerosene mixture made as follows. Slowly melt forty pounds of asphalt, heating no more than is necessary to liquefy it completely; stir in four gallons of kerosene, allow the mixture to cool and stir in three pints of a wood preservative such as Solignum, Noxo, or Brunolinum. If the mixture is too stiff for easy application it should not be heated but thinned by adding more kerosene. Its black surface should be whitewashed if exposed to the sun, to prevent the treated bark becoming overheated. Limewash is made by adding about three pounds of slaked lime to a gallon of water. Certain proprietary preparations can be used in place of asphalt kerosene mixture.

NON-PARASITIC INJURIES

The three commonest causes of physical wounding of trees of all ages are fire, lightning and sodium arsenite poisoning. Fire damage is of course recognisable at once. The other two produce effects that are easily mistaken for disease symptoms by those unfamiliar with them, frequently giving rise to alarm because of the sudden appearance of the trouble on many trees spread over a wide area. Fire damage requires immediate treatment. Little can be done about the other two, but it is helpful to know how to recognise them. Electric storms are frequent in the tropics and damage to plantations is commoner than is generally supposed. Accidental poisoning is always liable to occur where sodium arsenite is used.

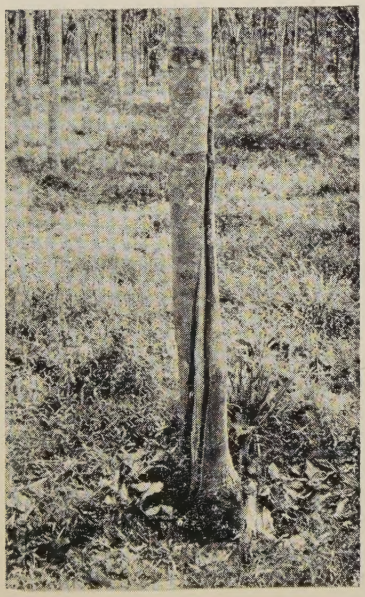
Fire Damage – Leaf fires sometimes occur in mature areas, scorching the bark low on the trunk. Far worse fires occur in young rubber, where sprayed and dead lalang burns so intensely when it is dry, that the trees are easily killed outright. Trees that are not fatally injured by the fire may be lost through attack by boring beetles, which are attracted to scorched bark. Once they have penetrated into the wood there is little chance of saving the tree. The chief aim in treating fire damage is therefore to forestall borer attack by scraping away scorched bark as soon as work is possible in the area. The extent of the damage caused by a fire may vary from superficial scorching of the outer layers of the bark to deep injury involving the whole thickness of the cortical tissues. Trees which appear only slightly scorched may not show the full extent of the damage until some days later, when bleeding occurs from the stem or tapping panel. A second round of treatment should therefore be made, say after ten days, to deal with these. If there are many trees to treat it is worthwhile making simple scrapers specially for the work. One way is to nail loops of hoop iron on to wooden handles and give them a suitable curvature. Dead bark should be scraped away until healthy tissue is exposed, and a wound dressing applied. Where the canopy of the burnt area is still dense it is best to apply a thin smear



of petrolatum, to stimulate recovery, renewing it as may be necessary after six months or so. Otherwise asphalt mixture should be used, followed by whitewash.

Lightning Damage — While a direct lightning strike may kill a tree at once, a less severe discharge will leave it severely wounded or will inflict internal injuries which become apparent only after several days have elapsed. Affected trees occur in groups; there may be a few only or more than a hundred in close planted young rubber. Symptoms often show up first on the centrally placed trees, less affected trees towards the margins reacting later, giving the misleading impression of the outward spread of a disease. The effects are very variable. Sometimes only the tops of the trees are killed, sometimes the damage is confined to the lower parts, sometimes to a single branch.

There is little difficulty in recognising lightning strike in which stems are split, strips are torn off the bark, and latex exudes. Less obvious, but ultimately as dangerous to the life of the tree, are internal injuries which may not be noticed until boring beetles begin to penetrate. Attention is sometimes drawn to an affected tree by a fall of green leaf with the stalks still attached. Lightly scraping the branches then often reveals a normal looking green layer beneath the cork, but on scraping deeper the cambium is seen to be discoloured faintly purple. The bark dies outwards from the cambium, in contrast with the way in which the bark dies when attacked by invading fungi—from the outside inwards.



One type of damage, observed on trees over two or three years of age, used to be called 'patch canker' and was regarded as a result of fungus attack. A canker may occur anywhere on the stem. When lightning has struck upwards from the ground, instead of downwards through the branches, a canker low down in the region of the bole may be the only visible injury. Cankers may be several inches across and exude a purplish fluid. On cutting

them open the inner bark, normally creamy white, is seen to be claret coloured. Latex pads form between the bark and wood.

Little can usefully be done to trees damaged by lightning. Dying trees should be cut out, and dying branches lopped off, the wounds being tarred or treated with asphalt kerosene mixture. Cankers should be cut away to healthy tissue and treated with a water miscible tar acid fungicide, followed by a dressing of petrolatum.

Wounds Caused by Sodium Arsenite Poisoning — Accidental sodium arsenite poisoning not infrequently occurs where the poison is used for weeding, either by the spray drift falling onto the stems of young trees or by uptake through the roots of solution spilt on the ground. In the former situation latex exudes, irregular patches of bark are killed and may be invaded by borers, but the poison does not spread. In the latter situation the poison passes through the root and up the stem, killing the wood in its path. The wood vessels that carry it turn brown, while the overlying bark dies. The region affected lies in a narrow band which may run right up the tree to the branches, and exhibits the slight spiral twist characteristic of the wood vessels, as shown in the photographs. This is because the poison reaches only those vessels supplied by the root that made contact with the solution.

Doubt as to whether or not an observed injury is caused by sodium arsenite poisoning can easily be resolved by a simple laboratory test for arsenic. Specimens sent in for testing should include for comparison both healthy and discoloured tissue. There is nothing that can be done to counteract the effects of arsenical poisoning, but it may be worth while to treat any wounds that occur at panel height, cleaning them up and applying petrolatum. They may not, however, be noticed until the bark overlying them starts to slough off.

Hormone and other herbicides that are used for weeding in place of sodium arsenite will also cause damage to rubber if they are allowed to come into contact with young trees. The effects that have been seen are more in the nature of general toxicity than of local wounding. Although their use is increasing they are still not employed on anything approaching the scale of sodium arsenite.

Air Dried Sheet

Air dried sheet can often be used to replace pale crepe in the manufacture of light coloured articles. The Research Association of British Rubber Manufacturers in England, who have carried out tests on a sample of air dried sheet, report that they find no evidence of inferiority in mechanical or ageing properties after vulcanisation, and possibly a slight superiority in the ease with which the raw rubber can be processed. The demand for air dried sheet, which is cheaper to produce than pale crepe, may be expected to increase, though pale crepe is likely to remain superior for delicately coloured articles and for articles that must not contain paranitrophenol, the fungicide with which air dried sheet is often treated to prevent mould growth.

Further Legume Covers

The three legume creepers most usually sown were described under 'Establishing a Legume Cover' in Planters' Bulletin 14. Notes on another legume, Flemingia congesta, appeared in Planters' Bulletin 5, and we now present a further selection, mainly to aid identification but also to record points of interest to planters.

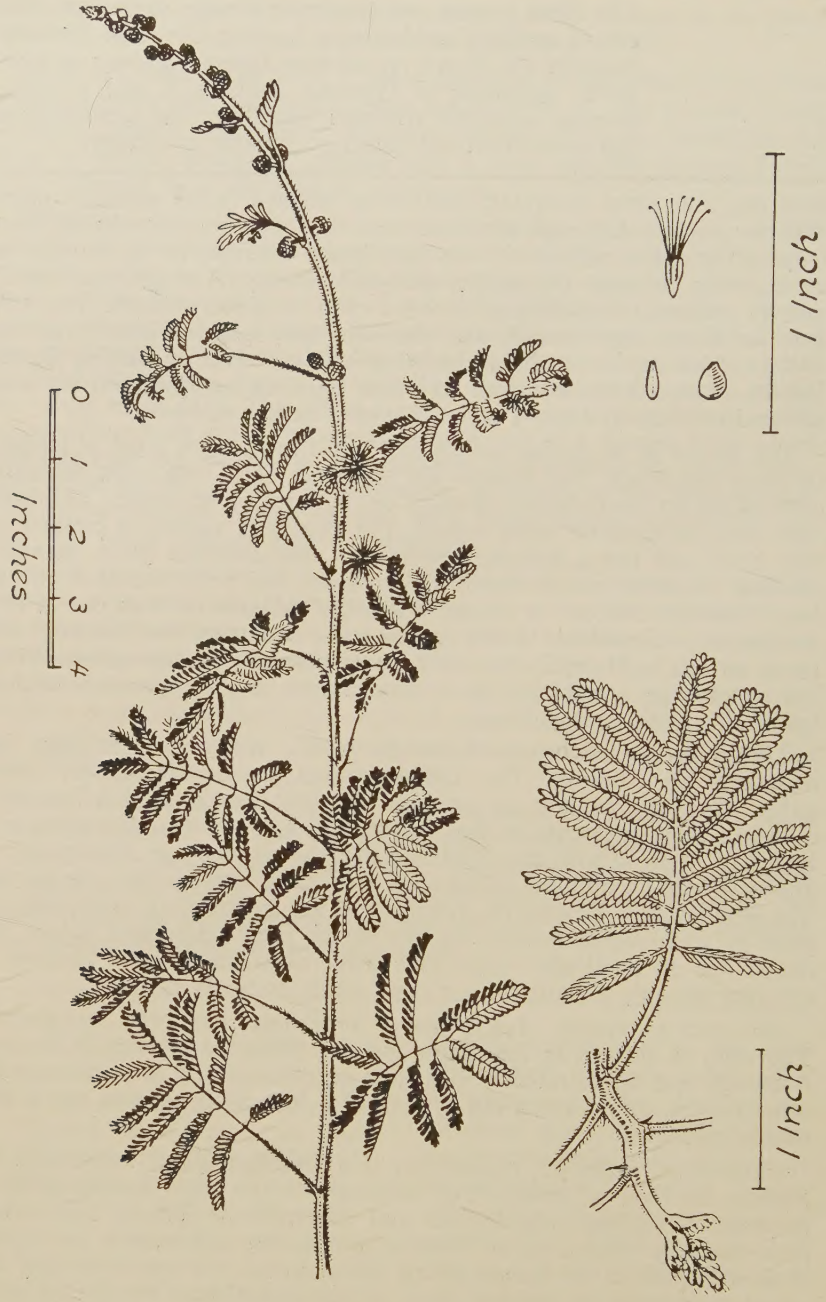
PERHAPS THE MOST FAMILIAR LEGUME in Malaya is the sensitive plant *Mimosa pudica.* Although so widespread this plant was introduced from tropical America, whence it was distributed throughout the tropics as an amusing curiosity during the sixteenth century. A tough and scanty growth makes it valueless as a cover crop or green manure. The stiff prickles leave sore wounds and the seed may poison cattle. Another species, *Mimosa invisa* differs in being a larger erect or trailing shrub, but its thorns detracted from its value until an unarmed variety was selected recently in Java. This is *M. invisa* variety *inermis.*

The leaves of *M. invisa* are divided into five or more pairs of leaflets of many segments. The flowers are spherical, each with eight stamens. The leaves do not collapse on touch as do those of *M. pudica,* although they fold at night or when wilted. The thornless variety is clothed in fine hairs and has a delicate appearance. An excellent green manure, its thick prostrate growth forms a good cover and keeps weeds in check, but it rapidly dies out in shade. When the old growth dries out in dry weather it is considered a fire risk in some countries, but this may not be so serious in Malaya where there is no pronounced dry season. Without supervision a stock of the variety *inermis* might degenerate by hybridisation with thorny forms.

The sensitive vetch, *Aeschyomene indica,* might at first sight be mistaken for *Mimosa.* The following features distinguish it: erect habit; about 3 feet tall; no prickles or hairs; leaves divided into two dozen or more segments, so that one leaf of *Aeschyomene* resembles one leaflet of *Mimosa* with the difference that the segments in *Aeschyomene* alternate with an odd one at the end, whereas in *Mimosa* they are paired. The small yellow flowers of *Aeschomene* are in structure miniatures of bean or *Centrosema* flowers, or any of the plants described below. *A. indica* has no particular value as a cover or green manure, because it survives for only a short time in open damp or sandy places.

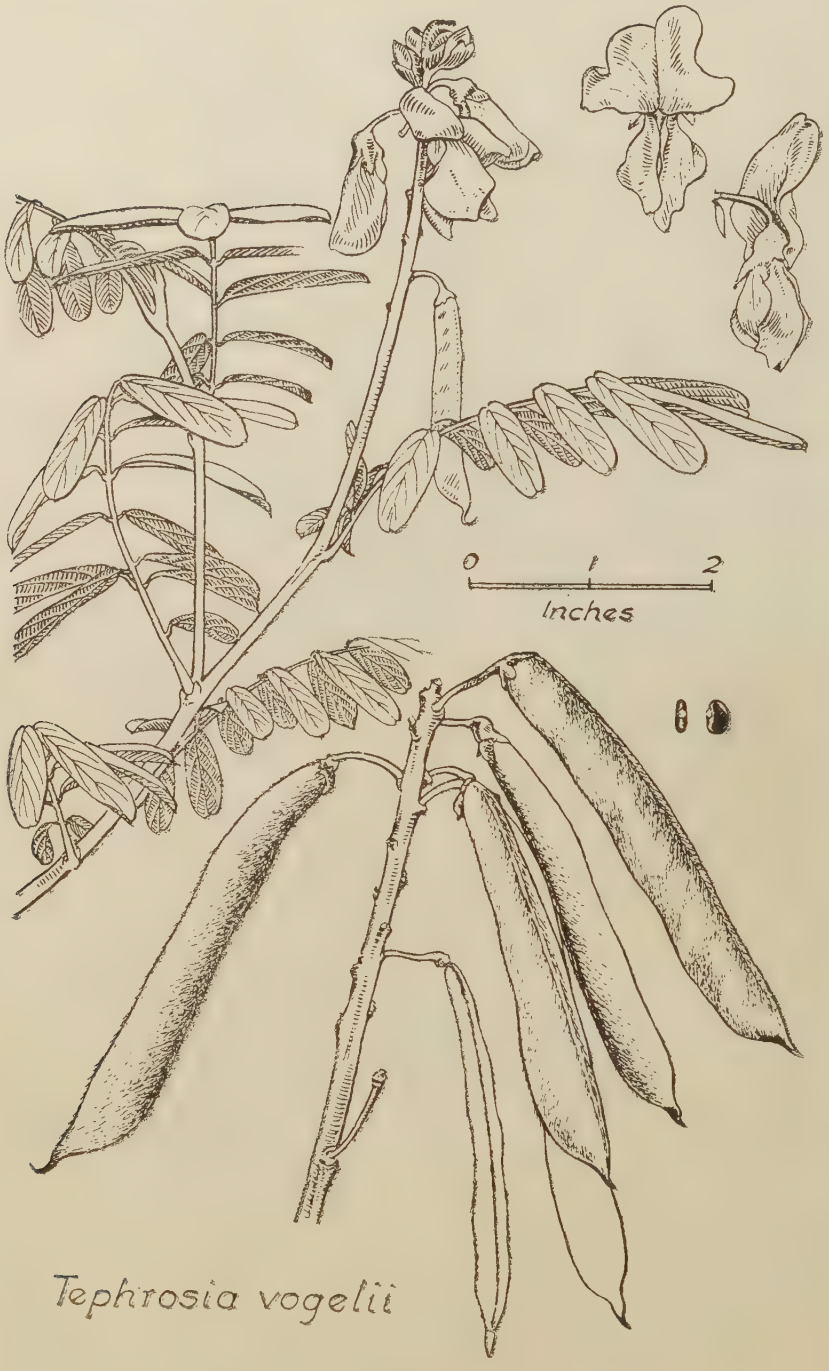
An erect perennial, *Aeschyomene americana,* has been introduced. The stem is clothed in fine hairs and the flowers are purplish mauve. Although not undesirable, it has little to commend it in preference to other covers, and when a tall growth of 6 feet or more dries out a fire risk is created.

Clitoria laurifolia (C. cajanifolia) is a Brazilian plant established in Malaya for over a century. The stickiness of the seeds has aided their dispersal. Note the ridged pods and the trifoliate leaves. This small erect shrub is reputed to be effective in checking soil erosion on slopes, if closely planted in hedges along the contours. *C. laurifolia* may be grown from seed or cuttings struck in damp soil. It is not always easy to establish in shade, but well grown plants are tolerant of shade and slashing. Although not a dense cover or a valuable green manure it should be encouraged among natural covers.



Mimosa invisa var. inermis

Clitoria laurifolia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Tephrosia vogelii

The pretty blue flowered *Clitoria ternatea* (each leaf has 5 to 9 oval leaflets) is grown as an ornamental climber in Malaya, but elsewhere it serves as a cover crop, pasture or green manure with various degrees of success.

Among the leguminous shrubs which were once popular are species of *Crotalaria* and *Tephrosia*. The latter are hardier cover crops and were recommended as vigorous plants for poor soils, but are somewhat disappointing in this respect. *Tephrosia vogelii*, a native of Africa, is illustrated. Unslashed it grows to ten feet. Most species of *Tephrosia*, including *T. vogelii* are poisonous in all their parts.

With the exceptions of *Clitoria laurifolia* and *Flemingia congesta*, few of the leguminous shrubs recommended in the past tolerate shade or heavy slashing. As a group they are susceptible to the root diseases which attack rubber trees and many are attacked by pink disease. Patches of the shrubs found dying off in an immature area may indicate root disease. Unless diseased shrubs are eradicated their woody roots harbour the fungus and transmit the infection by root contact.

Erect leguminous shrubs do not cover the soil so rapidly or as effectively as creepers and are unsuitable for control by mechanical methods. Therefore current opinion favours low trailing shrubs and creepers. In this class is the genus *Stylosanthes*, of which two species have been introduced into Malaya during the last five years. One is Brazilian lucerne, *Stylosanthes gracilis (S. guianensis)*, a perennial plant of prostrate habit, rooting at the nodes. The young shoots are herbaceous, but if ungrazed or uncut the growth becomes woody. In equatorial regions it rarely sets seed, but may be propagated by green cuttings. The low dense cover is a useful green manure but the Department of Agriculture has introduced it into Malaya because of its virtue as a pasture legume. If the present limited stocks become more widely available, planters may wish to experiment with this plant as a cover crop. Imported *Stylosanthes* seed should be broadcast at the rate of two pounds per acre, or cuttings planted at distances of 2 ft × 3 ft. It is not expected to survive under shade.

A dense sward of Stylosanthes

The other species, introduced from South Africa, is *Stylosanthes sudaica*. Similar in appearance to *S. gracilis*, it is less persistent but flowers more freely in the tropics. In *S. sundaica* the sheath-like leaf stalk bases are hairy, and a few scattered hairs are found elsewhere. *S. gracilis* is grosser in all its parts and the hairiness is more obvious being denser, more bristly, and extending even to the leaf backs. The flowers in both species are yellow at the base diffusing into an orange lip with dark almost purple guide lines.

Stylosanthes sundaica

Desmodium ovalifolium

A low shrub worthy of encouragement is *Desmodium ovalifolium*. This rarely flowers in Malaya, except in the North, so that seed must usually be imported. In the absence of seed, it may be propagated by cuttings. The leaves are simple or trifoliate, the latter being typical. Each leaflet is round, elliptic or oval in shape, and the terminal leaflet is larger than the other two. Leaves and young stem are clothed with

fine silky hairs. The flowers are pale lavender blue. The fruit is a thin, jointed pod, densely covered with hairs. Although the roots are frequently attacked by eelworms, *Desmodium* does not succumb so easily to this pest as some other legumes.

Comments of planters on the practical value of cover crops are always welcome. Knowledge of this subject is all too scanty and wherever a particular programme of management such as cattle grazing, poison spraying, encouragement of certain indigenous species or planting of others has been followed the results will be of value to us.

Mixed Farming and Intercropping

We again have pleasure in presenting a guest article by the Senior Agronomist of the Department of Agriculture. On this occasion the crops discussed are those which need regular supplies of farmyard manure, and which depend therefore on the keeping of livestock.

THE NATURAL VEGETATION of practically all rubber land in Malaya at one time consisted of tropical lowland evergreen rain forest. In so far as tree crops such as rubber, oil palms and kampong fruit trees more nearly resemble this natural vegetation than do short term arable crops, it is the former which fit more naturally into Malayan conditions while arable cropping requires both a high degree of skill and plenty of bulky organic manures. One day, some of the peat deposits which occur in many parts of Malaya may become available, but problems of baling and transport first require solution. Until then planters must keep livestock in order to provide farmyard manure.

Good stockmen are born and not made, and where a personal interest in animals is lacking planting companies should not force their managers to keep livestock. No amount of antibiotics or other feed supplements can provide a short cut to success.

Perhaps the most suitable livestock to provide plenty of bulky manure and a reasonable return on money invested is the pork pig. The half-bred Chinese Black × Middle White cross provides quick maturing porkers which suit the local market and the management is well understood by local Chinese. Accurate costing of pig keeping is easier if the breeding and rearing sections are kept separate.

Suitable crops to grow in association with pig keeping are sweet potato vines, tapioca, fodder grasses and vegetables. The last provide the cash crops which are sold off the estate, while the other three are fed to the pigs. This rotation would be quite suitable for intercropping between hedgerow rubber since the disturbance and exposure associated with a crop of tapioca need not cause soil deterioration provided that it is properly manured and grown in rotation. To go into greater detail would be out of place since any planting company interested in mixed farming would be well advised to employ a trained Chinese pigkeeper and vegetable grower.

Mixed cropping requires, of course, well drained, flat or gently undulating land. No attempt should be made to crop too large an area since heavy applications of farmyard manure are required on most soils in order to prevent physical deterioration.

Because tapioca is known to be attacked by white root disease of rubber, it may be questioned whether it should be grown as an intercrop. A single crop in rotation with others cannot be harmful to the rubber, however, and the only suitable alternatives are the greater yam and sweet potatoes grown for tubers. Of these the former is more troublesome to grow than tapioca while the latter yields less.

Pigeon Peas — This legume, *Cajanus indicus*, grows well in the semi-monsoonal north of Malaya but cannot be recommended elsewhere. It makes a vigorous bush cover and the spacing suggested is 6 ft × 4 ft with four seeds sown per point and thinned out later to one healthy seedling. On old rubber land the application of fertilisers recommended is:

	Per acre
farmyard manure or compost	10 tons
Christmas Island rock phosphate	200 lb
double superphosphate	65 lb
muriate of potash	50 lb

Up to 1 ton per acre of ground limestone might also be beneficial on some soils but this should be applied some weeks before the farmyard manure. The time to reach maturity varies greatly with variety but the first crop of pods can usually be harvested after 6 to 12 months. When cropping decreases, the bushes may be pruned back, manured and allowed to ratoon. Replanting may be necessary after about two years' cropping but this depends on health and vigour of growth. When pigeon peas are growing under suitable conditions they are susceptible to attack by mealybugs and may also be affected by *Ganoderma* root rot. On suitable well manured soil in the north the crop grows vigorously.

Immature peas make a good vegetable but this crop is usually marketed as dried pulse.

Pepper — Post-war prices for white pepper have exceeded $1,000 per picul but towards the end of 1954 the price was only $215 per picul and the long term trend is likely to be downward. Nevertheless it is a remunerative crop which comes into bearing in its third year and the generous treatment given enables it to be grown on relatively poor soils provided only that they are well drained. Since vines have a life of 20 years or more they must not be grown too close to the rubber and a spacing of 8 ft × 8 ft triangular in four rows is suggested. Hardwood stakes 3 to 4 inches square and 12 to 14 feet tall are used and these should be durable in contact with the ground. Suitable timbers are chĕngai, mĕrbau, bĕtis and tĕmpenis. The use of living supports for pepper vines leads to reduced yields and cannot be recommended while prices remain high.

Pepper requires skilled pruning and prospective growers are referred to the article on Sarawak practice in the *Malayan Agricultural Journal*, volume 35, page 208.

The normal fertiliser used by growers is prawn dust but soya bean cake is also applied and there is no reason to suppose that farmyard manure would not give equally good results. Some inorganic fertilisers can also be applied but dressings are so generous that a large proportion must be organic. In one fertiliser experiment a dressing of 12 cwt per acre per annum of prawn dust applied in four quarterly applications has led to a higher yield of berries than 8 cwt per acre per annum of

an inorganic fertiliser mixture containing 7% nitrogen, 6% phosphorus (as P_2O_5) and 20% potash.

On sloping land some erosion control is required but growers dislike creeping covers since these are difficult to control. However, less vigorous prostrate covers can be recommended such as *Indigofera endecaphylla* and *Desmodium ovalifolium*. Snails may be troublesome in such covers but regular baiting with a Meta bran mixture gives effective control.

Future prospects for pepper are difficult to forecast. Before the war it was considered the classical example of a product with an inelastic demand, and prices varied considerably. There is now a reliable and apparently increasing demand from the canned meat trade, so planting is less speculative than formerly. Nevertheless, the high post-war prices have encouraged extensive new plantings in North Borneo, Sarawak, Malaya and probably also in Indonesia, so the danger of overproduction should not be forgotten.

Ginger – This is a suitable rotation crop for estates situated on fertile Rengam series soils or the equivalent. Although ginger requires good cultivation, it has the merit of being almost the only root crop which is not attacked by wild pig.

The manurial programme suggested is:

	Per acre
In ridges before planting	
farmyard manure	15 tons
double superphosphate	80 lb
rock phosphate	200 lb
muriate of potash	100 lb
As one or two top dressings during growth	
sulphate of ammonia	200 lb
or liquid pig manure	—

Ginger is planted as sprouted seed rhizomes, and the spacing depends on whether hand or mechanical cultivation is contemplated. A convenient system for mechanical ridging and intercultivation is to space the rows 27 inches apart with seed rhizomes planted every 12 inches in the ridge. If the land is in poor heart or if cultivation has been inadequate the grower may have difficulty in establishing an even stand. At 27 inch × 12 inch spacing 19,360 seed rhizomes are required for planting one acre; this is equivalent to about 11½ piculs which at present prices would cost about $690. A spacing experiment harvested recently from not very suitable soil in Kuala Lumpur yielded 3,034 lb per acre (22.75 piculs) of fresh rhizomes.

DISCUSSION

All the systems of arable cropping which have been mentioned must depend on some degree of mechanisation for pre-planting cultivation, interrow weeding and harvest. All these operations would be easier with sole crops than with intercropping and possibly a combination of the two systems might be easier to manage than complete intercropping. This would depend on having a certain area set aside for tapioca, sweet

potatoes and vegetables, while fodder grasses and leguminous fodder covers could be intercropped with the rubber.

Whichever systems are adopted it is essential to guard always against physical deterioration of the soil.

E. F. ALLEN

Poisoning Hevea with 2,4,5-T

Frill girdling has been largely superseded, as a means of killing an old stand of rubber trees, by the cheaper method of ring barking. Both employ sodium arsenite. For the former we used to recommend pouring a 5 lb/gal solution into a frill girdle cut at a convenient height into the wood of the main stem. In the latter method, the solution was thickened with tapioca starch and applied as a thin paste to the wood after a ring of bark about 8 inches wide had been removed.

Not only are these methods laborious and time consuming, but sodium arsenite is highly dangerous to man and beast, and regulations under the *Poisons (Sodium Arsenite) Ordinance, 1949* have to be complied with. The search of our Botanical Division for a more convenient alternative led them to formulations of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), and early promise has been realised.

A solution of a derivative of 2,4,5-T in a gas oil can be prepared readily — details follow — and this needs only to be painted or sprayed onto the bark around the base of each tree from ground level to fifteen inches up. The trees lose their leaves and are usually dead within three or four months. Tapping may continue after the treatment, and for a while yields increase.

The active ingredient which we recommend is the normal butyl ester of 2,4,5-T. This can be obtained commercially as a liquid, and its strength is given in terms of 'acid equivalent'. Malayan Fertilisers Ltd and Imperial Chemical Industries (Malaya) Ltd supply it at a guaranteed strength of not less than 10 lb/gallon, at a cost of $68 a gallon, $17.50 a quart, or $9 a pint.

The other ingredient is a gas oil such as Shell diesoline or Standard Vacuum mobildiesel. This diesel oil costs 61 cents a gallon in 44 gallon drums ex storage point, and from 51 to 59 cents a gallon from the pump, depending on the distance of the pump from the supplying depot.

The formulation which we recommend is a 5% acid equivalent solution of normal butyl ester of 2,4,5-T in gas oil. This is obtained simply by diluting one part of the commercial preparation (10 lb per gallon acid equivalent) with nineteen parts of the diesel oil. A gallon of this mixture is sufficient for about 25 average trees, and a labourer can treat about 20 trees in an hour. The bark needs no prior treatment and the solution can be applied conveniently by a flat paint brush of 2½ inch width.

The cost per tree of average girth — say 40 to 45 inches — is about 16 or 17 cents for material plus about 3 cents for labour, a total of 19 or 20 cents for this treatment. Excavation some six months after poisoning has shown that all roots are killed by this time, as for sodium arsenite treatment.

Correspondence

The Editor invites the offer of brief letters for publication. Comment and queries arising from articles in PLANTERS' BULLETIN *are welcome.*

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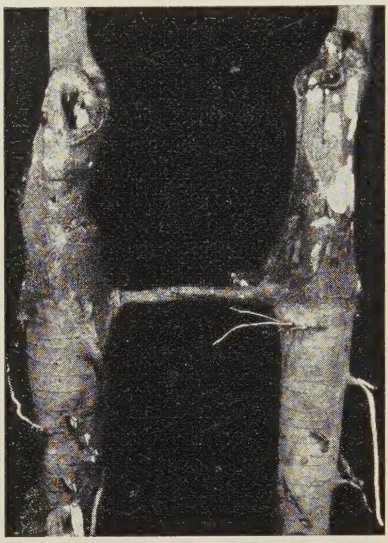
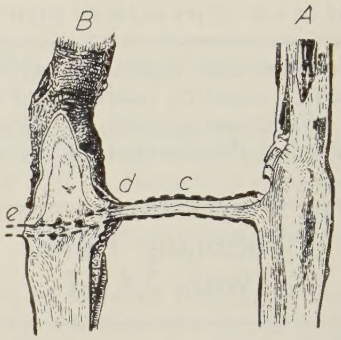
NATURAL ROOT GRAFTS



The enclosed photograph, showing two budded stumps joined together by a lateral root, may be of general interest. The girth of the lateral is three inches, in the centre. The stumps formed part of an old multiplication nursery laid down six years ago; they have been budded, cut back, and then budded again with another clone.

Moynalpy Estate
P.F. Blakey
Manager

Natural root grafts in hevea are common in old multiplication nurseries and in the field; we have several photographs of a lateral root from one mature tree joined to the tap root or to a main lateral root of a neighbouring tree.



We have sectioned your specimen. The diagram shows that the lateral root (c) of plant A touched the tap root of plant B, which in the course of time grew round it and finally enclosed it. Externally, this gives the illusion that the lateral (c) entered the plant B at (d) and passed out at (e). Unfortunately the outgoing root was trimmed flush against the tap root at (e), under the impression that it was a lateral root of plant B.—Editor

High Branching in RRIM '600' Series

Clones RRIM 600, 601, 613, 614 and 619 are late branching clones which grow tall during the first two years with a bottle brush habit. The branches, when they appear, are high on the trunk and are semi-erect. Thus a top-heavy crown is often formed.

As with clone LCB 1320, we advise removal of the terminal bud when the young buddings are about 10 to 12 feet tall. This stimulates branching at the desired level. Since ladder tapping is now an accepted practice it would be unwise to promote branching at a lower level on the main stem. The terminal bud may be pinched out or broken off by hand, cut off with a budding knife or lopped with a sharp knife.

Courses for Senior Estate Conductors

Refresher courses for senior estate conductors are offered this year at the R.R.I. Experiment Station during 30 May to 4 June, 13 June to 18 June, and 20 June to 25 June. Eight conductors can be taken on each course; they must be senior experienced men who are actually in employment, and all applications must be made by the managers of the estates concerned.

The programme will be mainly field work. Demonstrations, talks and lectures will include replanting and new planting procedures, weed control, establishment of legume covers, budgrafting and care of budded stumps, pests and disease treatments, manuring, tapping systems and yield stimulation.

Please apply early, to the Director.

Leaf Samples

Leaf samples sent to us for diagnosis of nutrient deficiency should be properly despatched to arrive fresh. They should not be sent at the weekend. Full instructions are given on page 21 of *Planters' Bulletin 4*, and these should be closely followed.

Notes on chemical and pathological sampling appeared in 1952 issues, on pages 40 and 50 and on page 69 respectively. Overseas readers should refer to the note on prohibited plant specimens, which appears inside the front cover.

OUR COVER SHOWS LEAVES OF A JUNGLE CLIMBER, BAUHINIA. SLASHED BACK THIS LEGUME ADOPTS A CREEPING SHRUBBY HABIT SUITABLE UNDER HEVEA.

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